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Descriptors-*Audiovisual Aids, Audiovisual Instruction, *Equipment Evaluation, Equipment Standards, Filmstrips, Information Dissemination, *Medical Education, Medicine, Phonograph Records, *Professional Continuing Education, *Programed Instruction, Slides, Surveys, Tape Recordings, Teaching Machines

Identifiers-*Audio Visual Equipment Directory, Department of Audiovisual Instruction, Medical Information Project, National Audio Visual Association, Society of Motion Picture and Television Engineers, Vis U Guide Responder 700

The Medical Information Project (MIP) purpose to select the right type of audiovisual equipment for communicating new medical information to general practitioners of medicine was hampered by numerous difficulties. There is a lack of uniformity and standardization in audiovisual equipment that amounts to chaos. There is no evaluative literature on such equipment and no better place to turn than to the "Audio-Visual Equipment Directory" which, essential though it is to this purpose, has many shortcomings. No machine listed in it, or discovered by an other survey, meets the requirements of MIP for individual programed instruction audiovisual (color slides and records) presentation. Factors that count in the selection of an audiovisual machine include the human factor, reliability, safety, technical requirements, cost, manufacturing, distribution, and maintenance considerations. The lack of standards raises problems of conversion which, allied with resulting manufacturing difficulties, makes costs prohibitive. Servicing and maintenance constitute a chronic problem which may be solved by the adoption of removable modules. Modules may also solve the problem of adapting a machine to different uses. Commercial machines and the test machine are illustrated and described. (GO)

MEDICAL INFORMATION PROJECT

School of Medicine School of Education
University of Southern California

<u>Research Memorandum Number 2</u>

AN ANALYSIS OF AUDIOVISUAL MACHINES FOR INDIVIDUAL PROGRAM PRESENTATION

by

James D. Finn
and Royd Weintraub

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Project Funded By
Bureau of Health Professions, Education, and
Manpower Training
National Institutes of Health
United States Public Health Service

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SECTION I

The Nature of the Study

Introduction

The purpose of the Medical Information Project is to develop and test a system designed to communicate new medical information to general practitioners of medicine. During the time the proposal was being prepared and the general concepts of the system invented, it was decided to use an audiovisual device which could be placed in the physician's office and which was capable of interruption and, therefore, designed for use in short bursts of spare time. After the project was funded, it was necessary to select the hardware which would carry the information to be presented to the doctor. It was from this requirement that the study reported in this memorandum was generated.

The Problem of the Study

The problem of this study was to locate and select a machine that would most nearly meet the ideal requirements of programing and intended use for the Medical Information Project, and which could be purchased in a lot of 100 at a price reasonably close to the original amount budgeted in the contract with the Bureau of Health Manpower, U. S. Public Health Service. Although the project had been designed with several possible machines in mind, it was now necessary to make a thorough study in order to get the best possible machine.

A Note on Previous Literature

Standards in the entire audiovisual field have been, in the last thirty years, talked about a great deal but never developed. It is only recently that national groups, such as the Department of Audiovisual Instruction of the National Education Association, seem to be making some headway in the development of standards for instructional hardware. At the moment the situation is chaotic; there is the conflict, for example, in the 8mm field where the standard frame size competes with "super 8" and the "M format"; various video tape recording systems are not compatible; there seem to be no standards of reliability except in such things as the Signal Corps' specifications for the JAN 16mm sound motion picture

projector.[1]

Chaos in the field of standards for all audiovisual equipment results in little, if any, evaluative literature on instructional hardware. It is true that some of the large city school districts in the United States, such as Los Angeles, set their own standards for bidding and purchasing, but these standards are not published and the results of evaluation are not available. The same situation probably holds true in the Armed Forces and certain large industries. For the great majority of educational users, there is no source which could be called a literature on equipment standards or equipment evaluation for the bulk of the new technology of instruction.

Furthermore, the nature of the industry producing audiovisual hardware is such as to discourage the creation of standards and any scientific process of evaluation. The National Audio-Visual Association (the major trade group) has avoided the standards problem as if it were a revival of the Salem witchcraft trials. The Society of Motion Picture and Television Engineers does develop standards for certain aspects of film and television applicable to education, but

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[1] The senior author was recently informed that, upon change of manufacturers, it was discovered that this equipment had not been built to standard, partly because the standard set was impossible without a great deal of additional expense.

other than such things as the proper number of sprocket holes per inch in a film, they have little significance for education; and in some cases, such as the super 8 - standard 8 controversy, the Society has retired to its bomb shelter, blessing both houses exactly as was done by other groups with speeds and sizes of sound recordings a few years ago.

Actually, standards for equipment and its subsequent evaluation for different purposes begin with design. We have only recently had any attention to the design of hardware specifically for educational purposes. As Leverenz and Townsley showed conclusively a few years ago, the state of the educational market is such that the producing industry was more or less forced to adapt hardware designed for other purposes to educational needs.[2] These adaptations were not very good but had to be accepted by educators because there were no other alternatives. Furthermore, as Finn pointed out in the introduction to the same publication, the educational community was so technologically illiterate and so diffuse in organization that good design was never demanded in the first place.

With no evaluative literature to refer to, there is no

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[2]Humboldt W. Leverenz and Malcolm G. Townsley, The Design of Instructional Equipment: Two Views, Occasional Paper No. 8, Technological Development Project, (Washington: the Department of Audiovisual Instruction, National Education Association, 1963).

place to turn in searching out equipment but to non-evaluative lists compiled by some agency or research worker. The major such compilation in the United States today is the <u>Audio-Visual Equipment Directory</u> published by the National Audio-Visual Association.[3] The <u>Audio-Visual Equipment Directory</u> is a very valuable publication and every effort is made to keep it up to date. However, it has some built-in weaknesses. For example, it does not list products of new companies or products under development but not released by established companies. It is, however, the one piece of literature that must be used in the start of any search for information on audiovisual devices.

It happens that, a few years ago at the height of interest in the first wave of teaching machines, several research groups undertook surveys of machines of the type somewhat related to the needs of the Medical Information Project. The definitive work was done by Finn and Perrin, and no further surveys have been published since that time.[4] Finn and Perrin reviewed the literature up to that time and located earlier surveys by

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[3] The edition used was the 12th Edition, 1966.

[4] James D. Finn and Donald G. Perrin, <u>Teaching Machines and Programed Learning: A Survey of the Industry - 1962</u>, Occasional Paper No. 3, Technological Development Project (Washington: Department of Audiovisual Instruction, National Education Association, 1962).

Lumsdaine (1959),[5] Fry, Bryan and Rigney (1960),[6] Foltz (1961),[7] Leavitt (1961),[8] Ross (1961),[9] Stolurow (1961),[10] and Sturwold (1961).[11]

In reviewing the Finn and Perrin study, it is interesting to note that, at that time, there were fourteen audiovisual machines (types somewhat similar to the machines needed in this study) of which eight were in full production and three in limited production. The remaining were in earlier stages of

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[5]A. A. Lumsdaine, "Teaching Machines and Self-Instructional Materials," Audio-Visual Communication Review (Summer, 1959), pp. 163-181.

[6]Edward Fry, Glenn L. Bryan and Joseph W. Rigney, Teaching Machines: An Annotated Bibliography, Supplement 1 of Audio-Visual Communication Review (Washington: Department of Audiovisual Instruction, National Education Association, 1960).

[7]Charles I. Foltz, The World of Teaching Machines (Washington: Electronic Teaching Laboratories, 1961).

[8]Jerome E. Leavitt and others, Programed Learning and Teaching Machines (Salem, Oregon: State Department of Education, June, 1961), mimeo.

[9]Wilbur L. Ross, Jr., Industry Survey and Buyer's Guide, unpublished mss. in possession of the Center for Programed Instruction (New York, 1961).

[10]Lawrence M. Stolurow, Teaching by Machine (Washington: U. S. Office of Education, Department of Health, Education and Welfare, 1961).

[11]Virginia G. Sturwold, "Sources of Self-Instructional Devices," Audiovisual Instruction (April, 1961), pp. 144-145.

development. Of the other twenty-six teaching machines using some kind of projected media, fourteen did not have a sound capability and six others were, essentially, group devices. Only two of the twenty-six were in full production.[12]

Of the fourteen audiovisual machines located in 1962, only about six appear to exist in one form or another today, although this estimate is subject to some error due to the fact that these machines seem never to disappear completely and may turn up later. In a yet unreleased book by Dorsett and Scott,[13] five manufacturers are listed as marketing audio-visual teaching machines at present. These are all full response machines and do not include individual audiovisual presentation devices with limited programing ability such as are of interest to the Medical Information Project.

In summary, then, the existing literature is not very helpful in describing the present state of the art of individual audiovisual teaching devices. There is little to find in the field of standards and evaluation, and the information concerning present developments in machines themselves is too old

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[12] Finn and Perrin, op. cit., pp. 26-31.

[13] Loyd G. Dorsett and Rosella D. Scott, Audio-Visual Teaching Machines (unpublished manuscript furnished by Mr. Dorsett of Dorsett Industries, Inc., Norman, Oklahoma).

to be of much help. This situation refined the problem and specified the method of this study.

Methodology

In order to make an intelligent selection of a machine, it was first necessary to state the human factors requirements as exactly as possible. This was done on the basis of the programing concepts selected, on a thorough review of the literature pertaining to the target audience, the general practitioner of medicine, and by discussion with experts in medical communication, both in the academic community and in the pharmaceutical industry.

Other requirements were added when the operational and economic factors became apparent as the project developed. These were: (1) reliability, (2) safety, (3) technical, (4) low cost production of software, (5) manufacturing, distribution and servicing.

Based on these requirements, a tentative set of specifications was drawn up and checked against the requirements. Following this, an evaluation form was designed from the specifications to be used for in-depth probing of each machine located. The evaluation form was checked by several technical and programing experts. The evaluation form appears as Attachment A.

A search was then instituted for machines. The NAVA Directory cited above was consulted for machines that might meet the specifications. About 45 machines were considered, of which approximately twelve were thought to be applicable. The companies producing these machines were contacted, and samples were obtained for study.

Since the NAVA Directory is not all inclusive, two additional steps were taken. Manufacturers listed in the Directory who had machines that seemed possible for the project were asked if they had newer models not yet listed. Several other machines were located this way. Following this, a search was begun throughout the industry using the contacts built up by the Department of Instructional Technology when it operated the Technological Development Project of the National Education Association (1960-1962). A portion of this search is shown in Figure 1. (Figure 1 was developed for another purpose - to illustrate information flow in an informal network - but it illustrates the methodology quite precisely).

Each machine located was either delivered to the University of Southern California for analysis, or was visited on site where, for proprietary or development reasons, the manufacturer did not want, at that moment, to ship the equipment.

INFORMATION FLOW THROUGH AN INFORMAL SURVEILLANCE NETWORK IN AN ACTUAL SITUATION DEALING WITH EDUCATIONAL TECHNOLOGY NOVEMBER–JANUARY 1966-67

Problem: To locate, test, and acquire an individual audiovisual device meeting certain programing criteria for a USPHS project in medical information

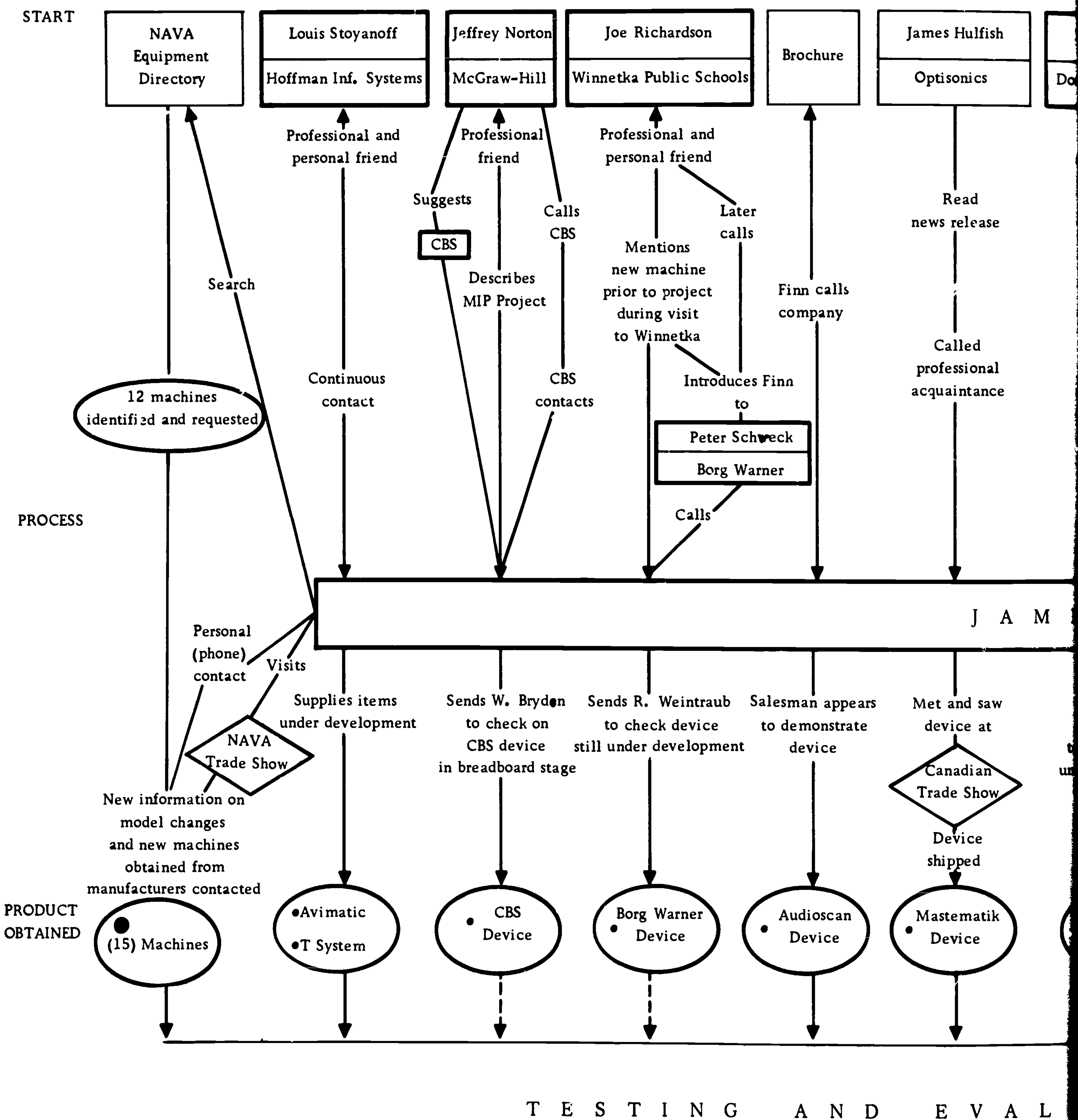
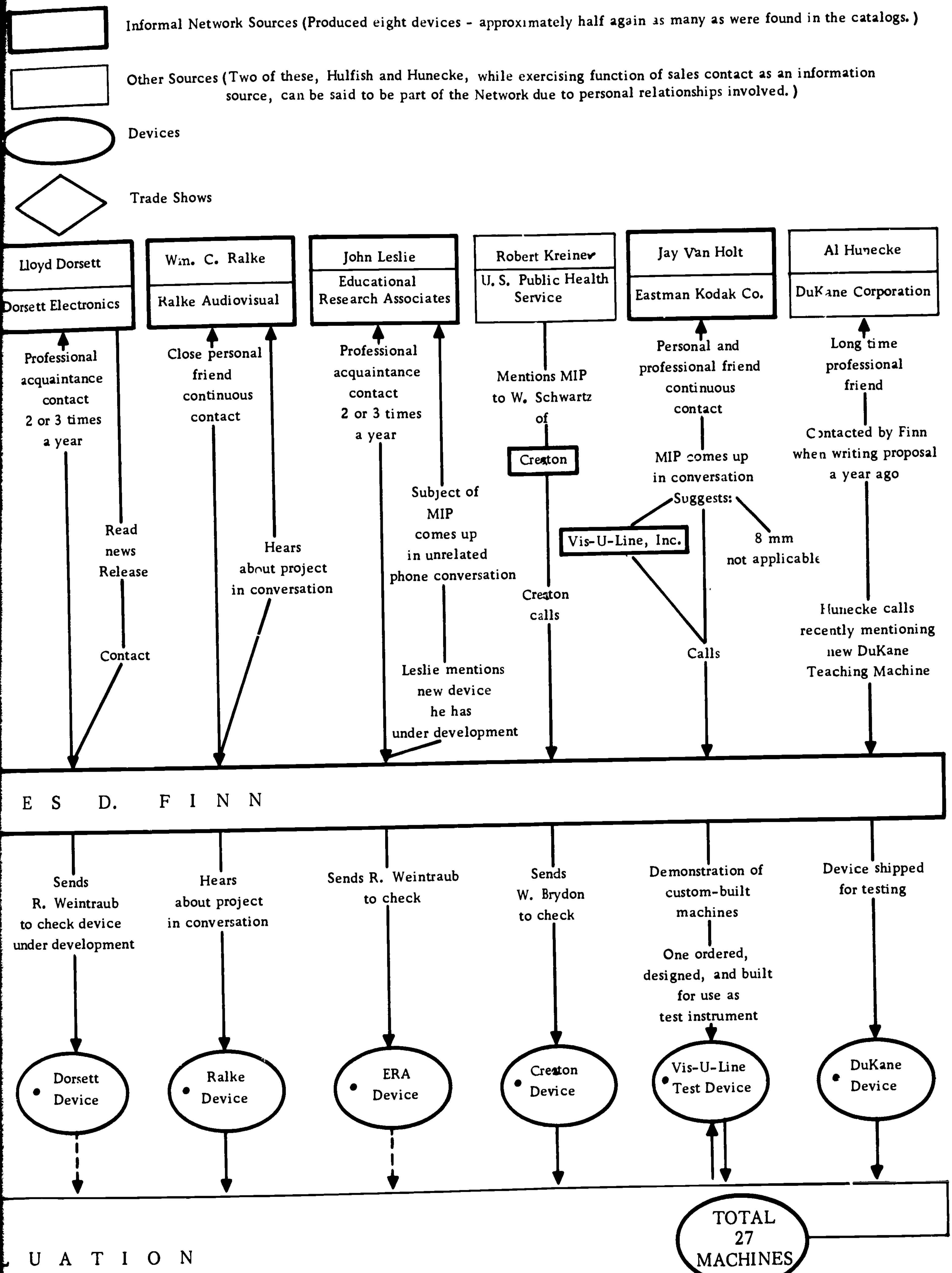


Figure 1



Informal Network Sources (Produced eight devices - approximately half again as many as were found in the catalogs.)
Other Sources (Two of these, Hulfish and Hunecke, while exercising function of sales contact as an information source, can be said to be part of the Network due to personal relationships involved.)
Devices
Trade Shows
Lloyd Dorsett
Dorsett Electronics
Wm. C. Ralke
Ralke Audiovisual
John Leslie
Educational Research Associates
Robert Kreiner
U. S. Public Health Service
Jay Van Holt
Eastman Kodak Co.
Al Hunecke
DuKane Corporation
Professional acquaintance contact 2 or 3 times a year
Read news Release
Contact
Close personal friend continuous contact
Hears about project in conversation
Professional acquaintance contact 2 or 3 times a year
Subject of MIP comes up in unrelated phone conversation
Leslie mentions new device he has under development
Mentions MIP to W. Schwartz of
Creston
Creston calls
Personal and professional friend continuous contact
MIP comes up in conversation
Suggests:
Vis-U-Line, Inc.
8 mm not applicable
Calls
Long time professional friend
Contacted by Finn when writing proposal a year ago
Hunecke calls recently mentioning new DuKane Teaching Machine
E S D. F I N N
Sends R. Weintraub to check device under development
Hears about project in conversation
Sends R. Weintraub to check
Sends W. Brydon to check
Demonstration of custom-built machines
One ordered, designed, and built for use as test instrument
Device shipped for testing
Dorsett Device
Ralke Device
ERA Device
Creston Device
Vis-U-Line Test Device
DuKane Device
TOTAL 27 MACHINES
U A T I O N

Site visitations were made in New York State, Norman, Oklahoma, Chicago, Albuquerque, New Mexico and Lansing, Michigan, and several other examinations were made at trade shows.

Following the analysis, a table was prepared listing the characteristics of each machine. The machines were then rated on each of a series of these characteristics and a second table prepared listing these ratings.

Essentially, the specification-characteristics of the machines were technical in nature. There yet remained the job of making some other estimates, somewhat more subjective. These included the capability of the company, the potential of the company for distribution and servicing of the equipment, especially when placed in remote locations, possible delivery dates in a time of back-ordering in the whole audiovisual industry, and the nature and requirements of software production

Price, of course, both of the hardware itself and the production cost of the software, also had to be a consideration. When all of the factors listed above were taken into account, obviously, several trade-offs had to be made. For example, the ideal machine might be too high priced and the promised delivery date six months too late.

The balance of this document will present, primarily, the technical aspects of this study. The ultimate decision

as to the machine selected will be conveyed to the Bureau of Health Manpower, U. S. Public Health Service, by letter.

The Requirements

The basic requirements for the audiovisual machine were derived from the programing strategy. The strategic decisions relating to programing which have a bearing on machine selection were:

1. The program will be presented in audiovisual form using a machine that can sit on a desk or table in a doctor's office.

2. The medium will be projected still colored pictures, reinforced by sound.

3. The programs will be approximately twenty-four minutes in length, broken up into units of five to six minutes each. A program, then, will have (usually) four self-contained parts. A subject may be covered in one, two, or more programs.

4. The program will present content in sequences of frames which will be followed by a frame which directs the physician to a program book, after which the machine will automatically stop. The book will require some sort of response - labeling a diagram, filling in a blank, selecting an alternative in a multiple choice question, etc. The doctor will then restart the machine for the next sequence. At the completion of the program a summary frame will be presented. Following this, on a form provided for this purpose, the physician will take a short content test which is self-scoring, and he will also evaluate the program.[14]

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[14] James D. Finn, Stephen Abrahamson and Diana Caput, Strategy and Tactics for Program Preparation, Research Memorandum No. 3 (Los Angeles: Medical Information Project, May, 1967), p. 4.

Specific requirements based on these programing concepts were set up in the following categories:

1. Human Design Requirements

(1) The machine must be as simple to operate as it is possible to devise. It should be, as has been said in the trade for many years, "idiot proof" (we hasten to add that we do not consider general practitioners of medicine idiots). This means that it should have a minimum of buttons, switches, etc. and that they should be clearly marked and easily accessible. The programs must be capable of being placed in, and removed from, the machine with a minimum of instruction and effort.

(2) The machine must not present a formidable appearance so that it looks as if it would take an astronaut to operate it.

(3) The machine must be aesthetically pleasing so that it would fit well in a doctor's office. In its general configuration, it should bear some resemblance to, but not necessarily look like, a small television set.

2. Reliability Requirements

(1) Due to the nature of the experiment - particularly with the machine operating for a full year in a physician's office at great distances from the experimental center - it must be exceptionally reliable. This means it ought to be virtually trouble-free in operation for an extended period of time. It should be capable of withstanding abuse such as dust, rough movement, etc. All moving parts must show strength tests suitable to the year-long operational requirement and the optical and electronic systems should be trouble-free.

3. Safety Requirements

(1) The machine should be absolutely safe in operation. The proper Underwriter's Laboratory requirements should be met.

(2) The machine should also be safe from itself - that is, properly fused and so designed as to shut off if in trouble.

4. Technical Requirements

(1) The machine should produce a high quality of picture and sound as judged in tests made by the Medical Information Project. The image should be visible with high resolution and good color in moderate illumination. The sound should be clear and distinct and of sufficient range to convey a sense of quality even if only voice is used on the recordings. There should be no wows or skipping.

(2) The machine should be of the smallest possible size and the lightest weight compatible with the reliability and technical requirements stated above.

(3) The machine should be so designed that it may be repaired easily. Electronic circuitry should be, if possible, designed in easily replaceable modules. Other systems should also be so designed. The machine's cover or other protection parts should be easily removed and the parts or circuit boards easy to get at.

5. Software Production Requirements

(1) The machine must use a record as the source of the sound (see the special note below for the reasons for this decision).

(2) The unit reproduction cost for the program package must be as low as possible compatible with the ease of using the machine stated in 1 (1) above.

(3) The program package must be capable of being wrapped and mailed easily.

(4) The software, particularly the visual form, must be compatible with the largest possible number of other forms of audiovisual presentation or easily and inexpensively convertible to such forms, e. g., slides to filmstrips. Odd sizes and shapes are to be discouraged.

6. Manufacturer's Requirements for Manufacturing, Distributing and Servicing

(1) The manufacturer must demonstrate, either by his previous performance and reputation or by other means such as performance and experience in a related enterprise, that he has the resources to manufacture, deliver, distribute and service the machines without depending on the contract for funds to try and do so. This statement is intended to cover the electronic, optical, and mechanical systems of the equipment.

(2) The manufacturer must have enough field men or an operating dealer's organization so that, under the contract, he can deliver, through a personal visit from one of his staff or dealers, a machine to each of the one hundred physicians in the sample and explain the workings of the equipment to the doctor so that the doctor will understand it.

(3) The manufacturer will be required to keep, at a point as close as possible to each doctor in the sample, sufficient extra machines so that one may be supplied in the event of a breakdown within forty-eight hours. It is estimated that this reserve of machines should be at least ten percent of the purchased lot, or 10 machines.

A Note on Records Versus Tape

A decision was made fairly early in the project to require records rather than tape, although tape machines are reported in this study. This decision was made on two bases. In the

first place, it is commonplace in the communications industry that, above a relatively small number, it is cheaper to produce duplicates by stamping records than by duplicating tapes. Secondly, as we tested various machines we felt that tape was less reliable. We made several fairly long runs on tape cartridges and were not completely satisfied with the results. Further, while a record may be damaged, it is not subject to twisting and breakage as is tape. For small runs and individualized custom programing, tape, of course, has many advantages.

Summary of the Approach

Once the requirements were set in the context of the programing strategy and the nature and distribution of the experimental population, the evaluation sheet was prepared, and the machines located and examined. In most cases, it was possible to test the machines in various ways and to take them apart for thorough examination. In a few cases, such as the Borg-Warner device, which was still in the prototype stage, this was not possible, although this machine was observed being operated by children and a good idea of its reliability was obtained.

Individual manufacturers were supplied copies of the evaluation sheet and they were asked to fill in the technical

data. All manufacturers that we contacted replied. Technical brochures on all equipment which were available were also obtained. Following this, each machine was rated on a number of points and each machine was photographed from several points of view. The results of this evaluation procedure are reported in the next section.

SECTION II

Results

Introduction

The material presented in this section covers the results of the machine evaluation study for the Medical Information Project. The results, as will be noted, are presented in summary tabular form and by photographs. These are followed by a brief discussion of the state of the art and the needs of the future. Attachment B at the conclusion of the formal paper is a brief report on a special test machine which was built for the project. Persons concerned with audiovisual programing techniques may find Attachment B of some interest.

The General Characteristics of the Machines

Table I presents the technical characteristics of the machines which were studied. Table I is followed by a series of pages of photographs of the machines. Please note the column in Table I which codes the page number of the photograph to the machine in the table. Attachment C is a list of all the companies contacted together with addresses and names of people contacted.

TABLE I - Page 19

	Size and Weight (inches)	Amplifier Electronics: Solid State or Tube	Projector: Rear, Front or Wall	Screen Size	Lens	Speaker Size (inches)	Lamp	Visual Format / Audio Format	Cooling System	Max. Time: Audio and Visual	Pulse Audible During Playback	Pulse Available for Advancing Visual	Pulse Available to Stop for Questioning	Program Change Time	Page
AUDISCAN, INC. MODEL: AUDISCAN I	9x10x14 13 lbs.	1 watt s.s.	rear	5 1/4x7	f 1.4 12.5mm	3	150 watt	16mm continuous loop 1/4" tape continuous loop- 3 3/4 i.p.s.	convection fan & squirrel cage blower	25 min.	no	yes	yes	@ 10"	27
BESELER COMPANY MODEL: BESELER SALESMATE	17x13x6 19 lbs. fold-out case	3 watts s.s.	rear	9x12	f 2.0 1"	4	300	single frame continuous loop on spindle - 1/4" tape magazine cartridge - 3 3/4 i.p.s.	dual convection fans	17 min.	no	yes	no	@ 2' 30"	26
CREATRON SERVICES, INC. MODEL: 750	20x10 3/4 x5 1/4 23 lbs.	1 1/2 watts	front	10x10	f 3.5 4"	4	500 watt	double frame slides in rotary tray 3 3/4 & 1 7/8 i.p.s. - 1/4" tape on reel	squirrel cage blower	100 slides 3 hrs.	no	yes	no	@ 1' 30"	30
DORSETT INDUSTRIES, INC. MODEL: M20	9x9x5 6 lbs.	1 1/2 watts s.s.	----	2 3/4x 3 1/2	none	3	---	printed paper roll 7" record	none	75 frames 30 min.	yes	yes	yes	@ 2' 30"	24
DORSETT INDUSTRIES, INC. MODEL: M70	12x9x5 8 lbs.	1 1/2 watts s.s.	front	3x4	f 1.4 12.5mm	3	4 1/2 watt	16mm strip 7" record - 16 rpm	none	30 frames 30 min.	yes	yes	yes	@30"	29

TABLE I - Page 20

	Size and Weight (inches)	Amplifier Electronics: Solid State or Tube	Projector: Rear, Front or Wall	Screen Size	Lens	Speaker Size (inches)	Lamp	Visual Format / Audio Format	Cooling System	Max. Time: Audio and Visual	Pulse Audible During Playback	Pulse Available for Advancing Visual	Pulse Available to Stop for Questioning	Program Change Time	Page	Row
SZTT INDUSTRIES, INC. EL: A	18x11x10 15 lbs.	1 1/2 watts s.s.	front	5 1/2x 7 1/2	f 1.5 15mm	3	4 1/2 watt	35mm single frame filmstrip - up to 12" record,4 speed	none	100 frames 50 min.	yes	yes	yes	@ 1'	29	2
ANE CORPORATION EL: MATIC	15x13x18 17 lbs.	2 watts t.	rear	9x7	f 3.0 2 1/4"	3x5	100 watt	35mm single frame on spindle - 12" record	convection fan	200 frames 20 min.	yes	yes	no	@ 1' 30"	27	1
ANE CORPORATION EL: A 525	15x13x18 17 lbs.	2 watts t.	rear	9x7	f 3.0 2 1/4"	3x5	100 watt	35mm single frame on spindle - 12" record	convection fan	200 frames 20 min.	yes	yes	yes	@ 1' 30"	25	2
CATIONAL RESEARCH OCIATES EL: 501	30x28x16 60 lbs.	2 watts s.s.	rear	4x8	--	No speaker:external jack	300 watt	4 tracks on 35mm film + 8mm motion loop - 4 channel 1/4" tape	convection fan + squirrel cage blower	160 frames 20 min.	no	yes	yes	@ 2'	25	1
OPTOSONICS CORP. EL: TERMATIC I	13 1/2x 17 1/2x 6 3/4 18 lbs. flip-up case	3 watts s.s.	rear wall	8x 10 1/2	2 interchangeable lenses f 12.8 22mm - f 3.5 75mm	4	300 watt	combined A-V cartridge,35mm single frame continuous loop - continuous loop 1/4" tape	convection cooling	18 min.	no	yes	yes (with small modification)	@ 15"	29	3

TABLE I - Page 21

	Size and Weight (inches)	Amplifier Electronics: Solid State or Tube	Projector: Rear, Front or Wall	Screen Size	Lens	Speaker Size (inches)	Lamp	Audio Format / Visual Format	Cooling System	Max. Time: Audio and Visual	Pulse Audible During Playback	Pulse Available for Advancing Visual	Pulse Available to Stop for Questioning	Program Change Time	Page	Row
XECUGRAPH (ARGUS) ODEL: 03	12x12x5 14 1/2 lbs. flip-up case	6 watts s.s.	rear front wall	7 1/4x 10 1/2	f 3.0 2"	3x5	500 watt	cartridged 35mm double frame fwd. or reverse - 1/4" tape cartridge	squirrel cage blower	20 min.	no	yes	no	@ 25"	27	2
OFFMAN INFORMATION YSTEMS ODEL: MARK IV (MODIFIED)	14 1/4x 12x 14 1/2 17 lbs.	1 1/2 watts s.s.	rear	5 3/4x 8	f 3.5 50mm	No speak-er:ex-ternal jack	150 watt	35mm single frame hermetically sealed in plastic sprocketed case - 45 rpm record	convec-tion fan	14 frames 6 min.	no	yes	yes	@ 10"	26	1
GHES AIRCRAFT DEL: DEOSONIC 102 B	10x12x18 25 lbs.	2 watts s.s.	rear wall	8 1/2x 6	f 3.5 1"	4x6	100 watt	35mm double frame Airequipt car-tridge - twin 1/4" reversible reel cartridge - 1 7/8" i.p.s.	squirrel cage blower	36 slides 1 hour play on each	no	yes	no	@ 1'	28	2
GHES AIRCRAFT DEL: DEOSONIC 901	11x13x14 22 lbs.	2 watts s.s.	rear	6 3/4x 10 1/2	f 3.5 2"	4x6	150 watt	35mm double frame Airequipt car-tridge - twin 1/4" reversible reel cartridge - 1 7/8" i.p.s.	convec-tion fan	36 slides 1 hour play on each	yes	yec	no	@ 1'	28	3

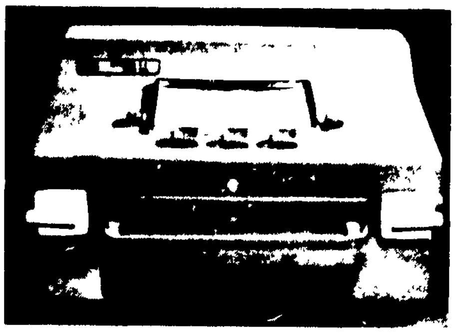
TABLE I - Page 22

	Size and Weight (inches)	Amplifier Electronics: Solid State or Tube	Projector: Rear, Front or Wall	Screen Size	Lens	Speaker Size (inches)	Lamp	Audio Format / Visual Format	Cooling System	Max. Time: Audio and Visual	Pulse Audible During Playback	Pulse Available for Advancing Visual	Pulse Available to Stop for Questioning	Program Change Time	Page
ABELLE INDUSTRIES, INC. ODEL: OURIER	17x12x6 15 lbs.	2 watts s.s.	rear	6x8	f 3.0	3	50 watt	35mm single frame on spindle - Cousino cartridge tape 3 3/4 i.p.s.	convection fan	17 min.	no	yes	no	@ 2' 30"	24 2
AST DEVELOPMENT CO. ODEL: 1700 MODIFIED TO INCLUDE UDIO)	14x7 3/4 x7 11 lbs.	1 watt t.	rear	4x6	f 4.0 30mm	no speaker: external jack	50 watt	1/2 longitude of single frame with center sprocket - transcription belt	none	200 frames each direction 6 sec.	no	yes	yes	@ 45"	24 3
ALKE COMPANY, INC. ODEL: CUSTOM BUILT USINO 7341 AFLEX 3452	12x10x7 18 lbs.	3 watts s.s.	rear wall	14x15	f 3.0 3"	3	150 watt	35mm single frame filmstrip - 1/4" tape cartridge	convection fan	150 frames 30 min.	no	yes	yes	@ 45"	26 3
NOSCOPE, INC. DEL: NOSCOPE MASTER	22x15 1/2 x11 36 lbs.	10 watts s.s.	rear	10 1/4x 10 1/4	f 3.5 4"	5x9	500 watt	35mm double frame slides rotary cartridge - 1/4" twin reel 1 7/8 and 3 3/4 cartridge	squirrel cage blower	80 frames 1 hr.	no	yes	no	@ 1' 30"	25 3

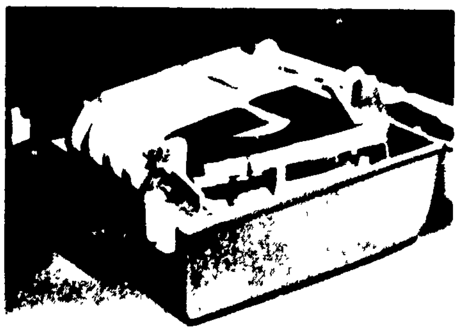
TABLE I - Page 23

Row	1	1
Page	28	30
Program Change Time	@ 1' 30"	@ 20"
Pulse Available to Stop for Questioning	no	yes
Pulse Available for Advancing Visual	yes	yes
Pulse Audible During Playback	yes	no
Max. Time: Audio and Visual	200 frames 4 speeds 30 min.	100 frames 10 min.
Cooling System	convec-tion fan	convec-tion fans
Visual Format Audio Format	35mm single frame filmstrip - 4 speed records	35mm single frame filmstrip in cartridge - 7" record 33 1/3 rpm
Lamp	75 watt	50 watt
Speaker Size (inches)	3	3
Lens	f 3.5 2"	f 3.5 2"
Screen Size	8x10	4 1/4x 5 3/4
Projector: Rear, Front or Wall	rear	rear
Amplifier Edlectron-ics: Solid State or Tube	1 1/2 watts t.	2 watts s.s.
Size and Weight (inches)	15x15x5 13 1/2 lbs.	8 1/2x 12 1/2x 19 1/2 7 3/4 lbs Visual Unit: 7 5/8x 10 1/2x 9 1/4 5 1/2 lbs Audio Unit: 4 3/4x 10 1/4x 8 1/4 4 3/4 lbs
	IEWLEX,INC. ODEL: I-1	IEWLEX,INC. ODEL: .V.T.D. WITH MODIFICATIONS)

DORSETT MODEL M20

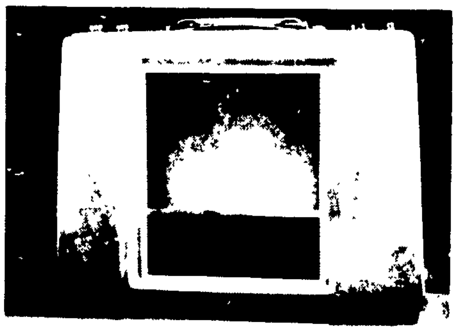


Front View

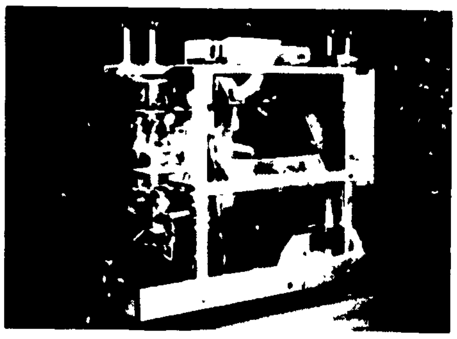


Interior View
Showing Program

LA BELLE COURIER

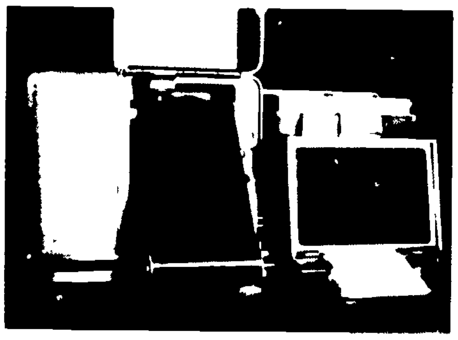


Front View

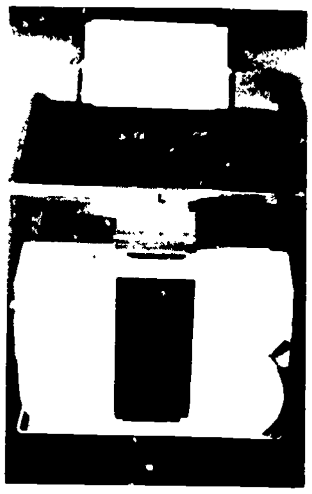


Interior View Showing
Mechanism and Program

MAST AV UNIT

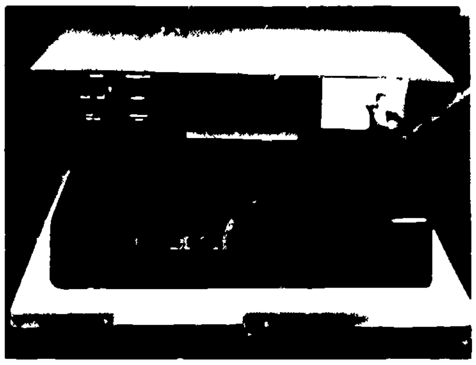


Front View

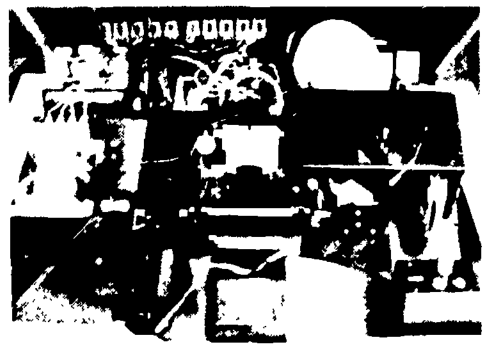


Top View
Showing Visual Unit
and Program

ERA 501

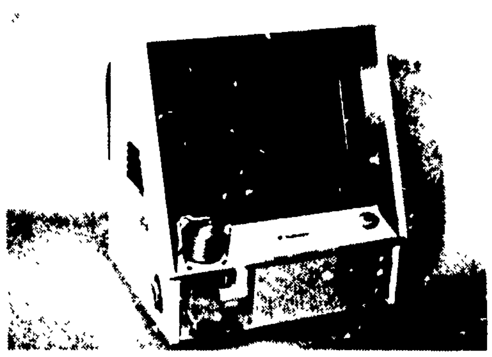


Front View

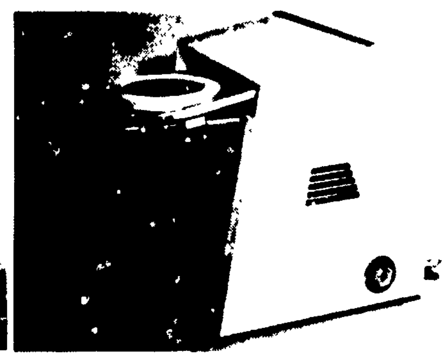


Interior View

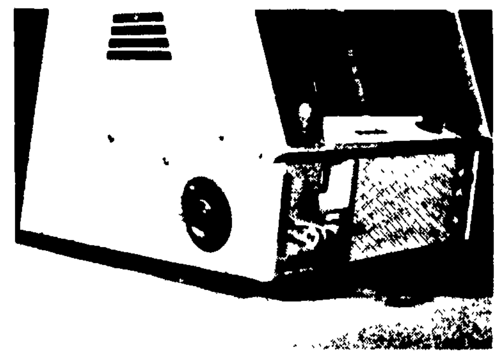
DU KANE 14 A 525



3/4 Front View

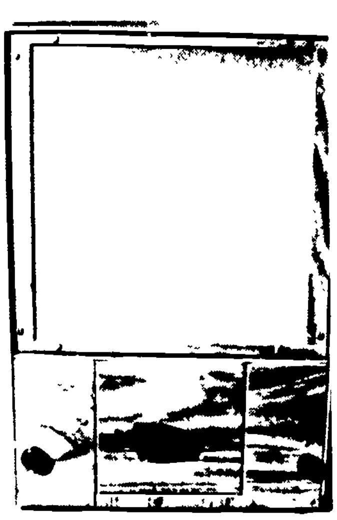


Side View
Showing
Phonograph Unit

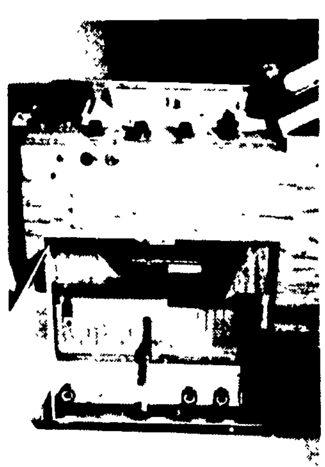


Detail of
Control Panel

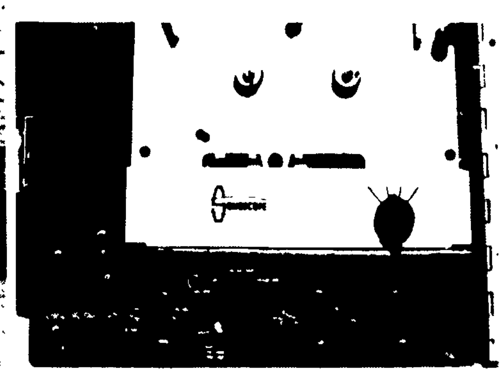
SONOSCOPE



Front View

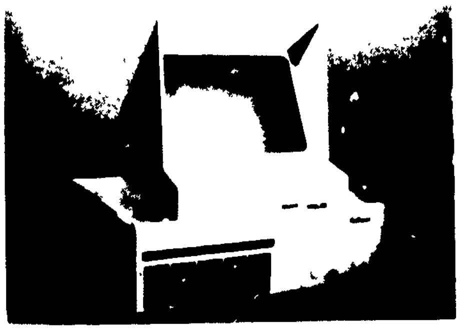


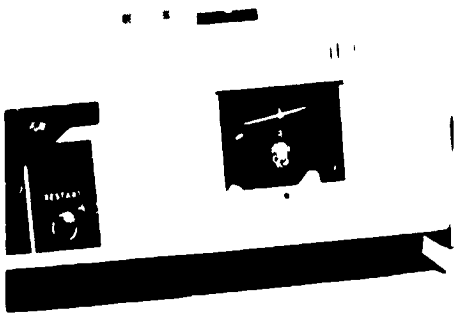
Side View
Showing
Tape Deck
and Projector

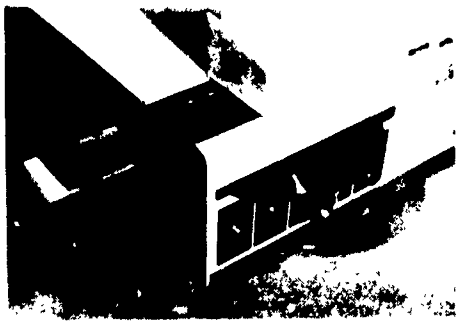


Detail of
Tape Unit

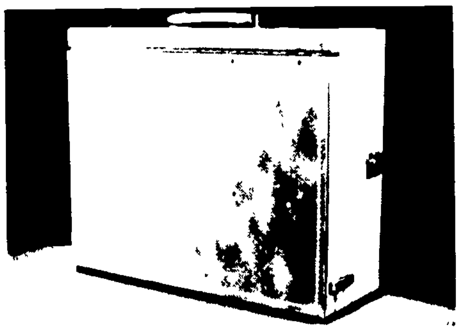
HOFFMAN MARK IV

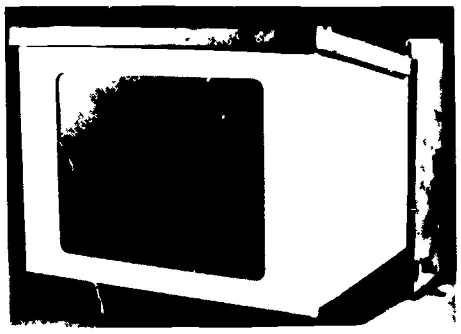

3/4 Front View

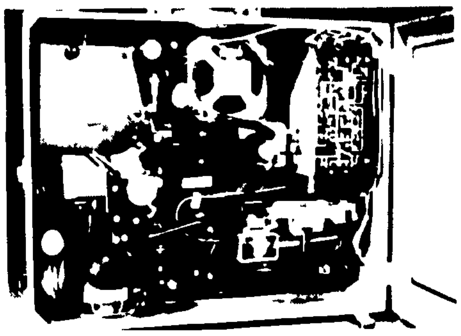

Detail of Lamp House


Detail Showing Placement of Program Materials

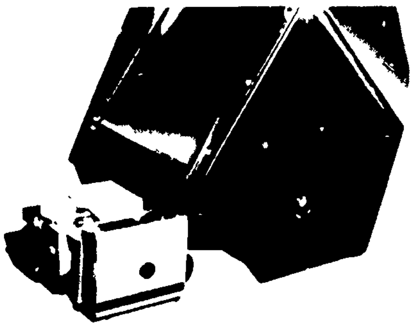
BESSLER SALES MATE

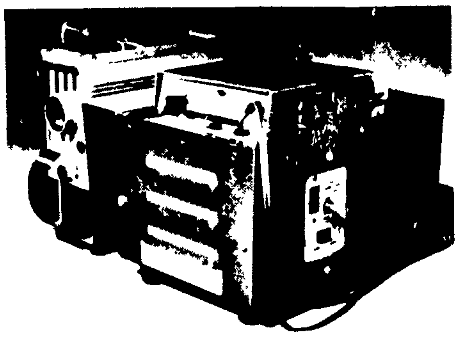

3/4 Front View: Ready for Storage

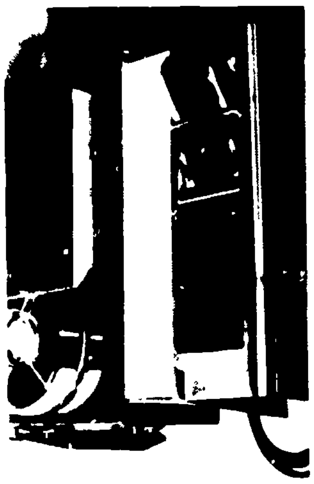

3/4 Front View: Ready for Operation


Rear View Showing Interior Mechanism and Program

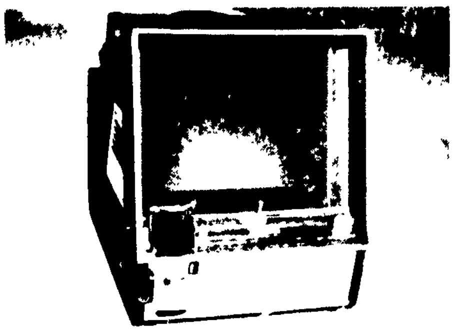
RALKE GRAFLEX COUSINO CUSTOM


3/4 Front View


Detail of Projector and Tape Unit

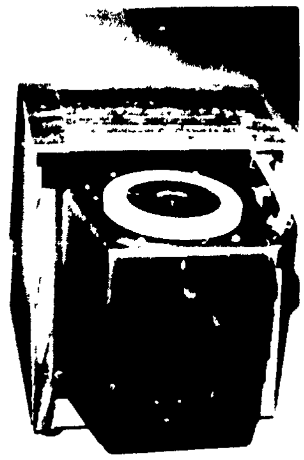

Detail of Mock-Up Control Panel

DU KANE AV MATIC



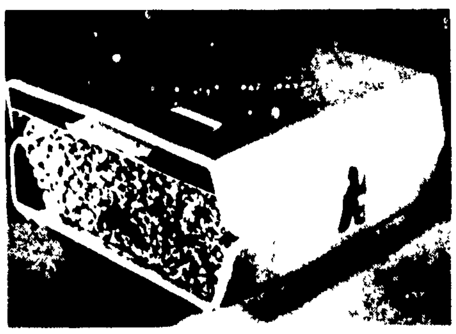
Front View

Detail of
Control Panel

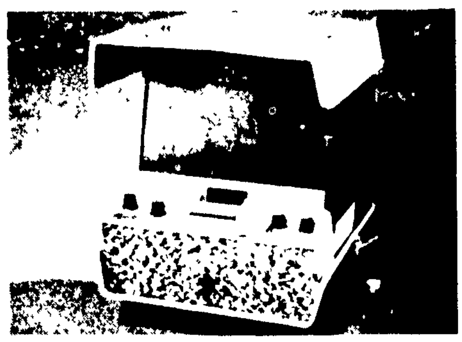


Rear View
Showing
Record Player

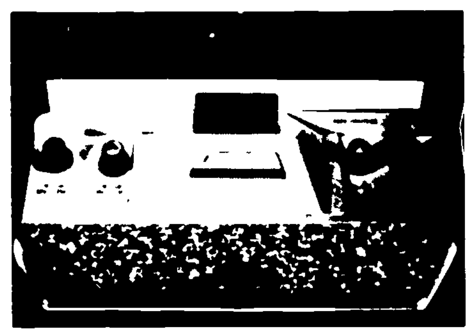
EXECUGRAF 303



3/4 Front View:
Ready for
Storage

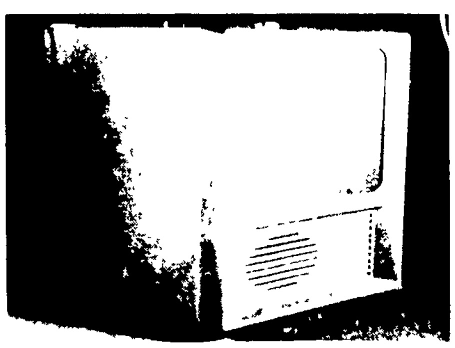


3/4 Front View:
Ready for
Operation

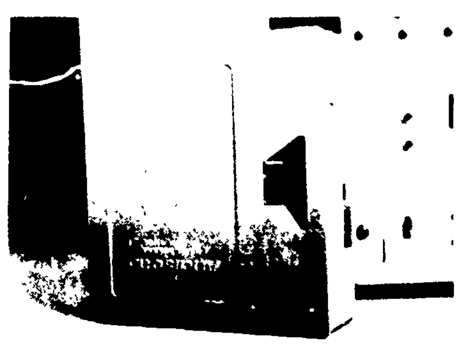


Detail of
Control Panel

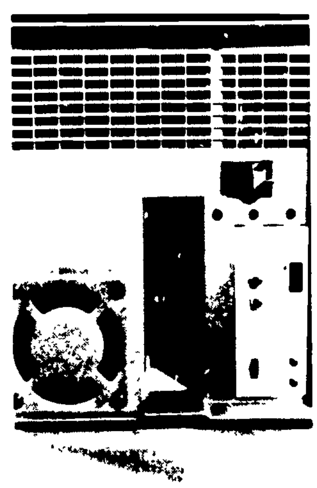
AUDISCAN I



3/4 Front View

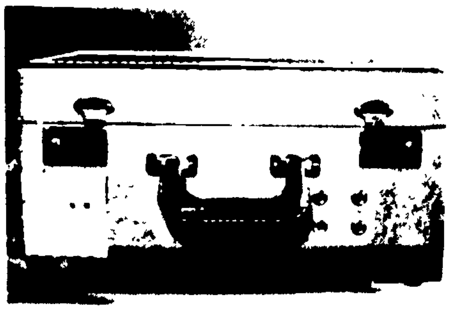


Cartridge for
AV Program

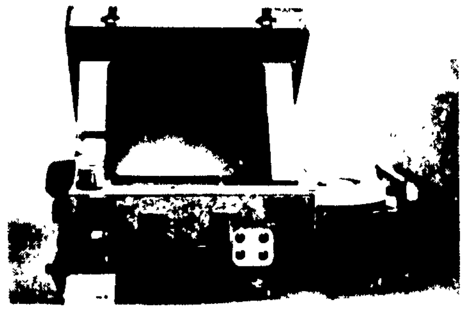


Rear View
Showing
Control Panel

VIEWLEX TT-1



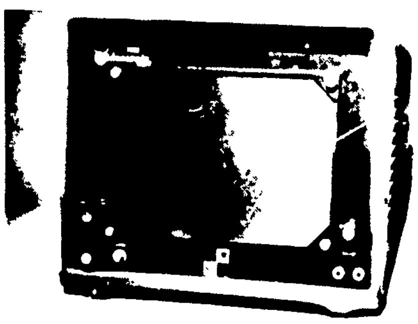
Front View:
Ready for
Storage



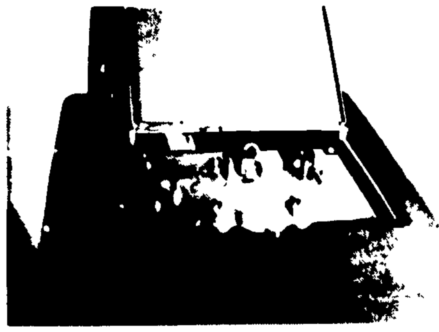
Front View:
Ready for
Operation

Detail of
Record Player

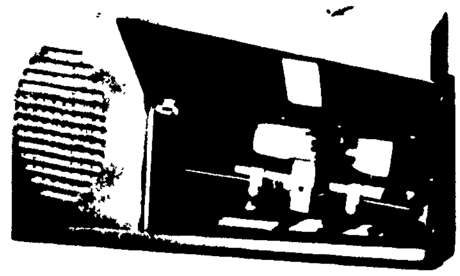
VIDEOSONIC 102 B [redacted]



Front View

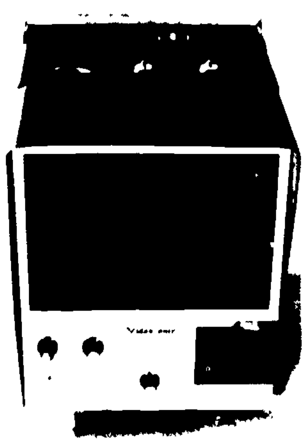


Detail of
Tape Deck

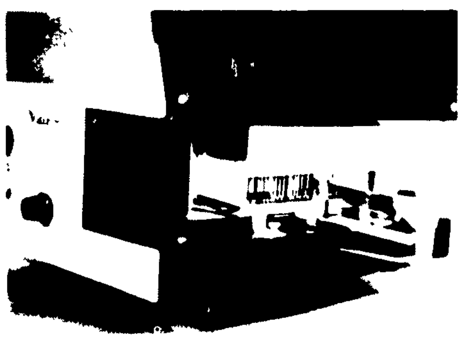


Detail of
Slide Mechanism

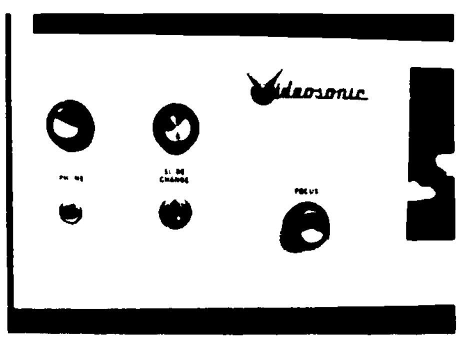
VIDEOSONIC 901



Front View

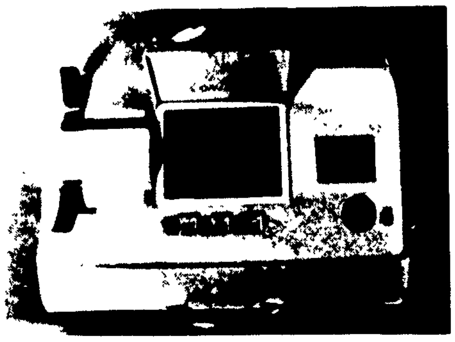


Detail of
Slide Changer

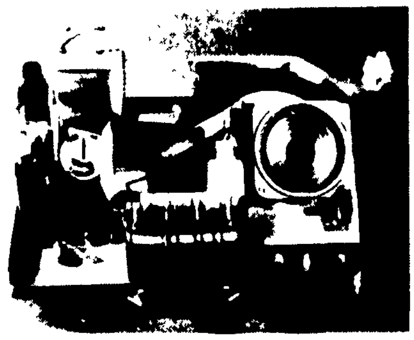


Detail of
Control Panel

DORSETT MODEL M70



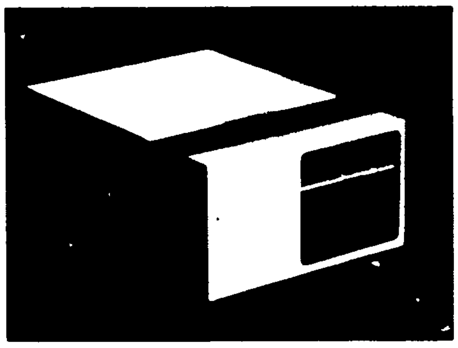
Front View



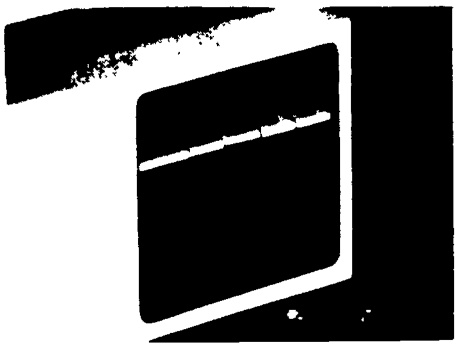
Front View
of Interior

Detail of
Projector

CBS-AVTD

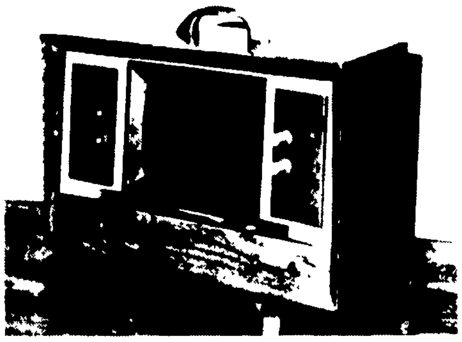


3/4 Front View



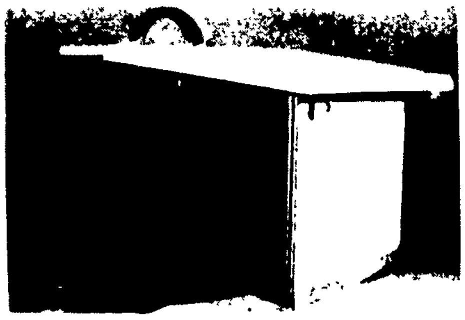
Detail of
Response Buttons

DORSETT MODEL M86A

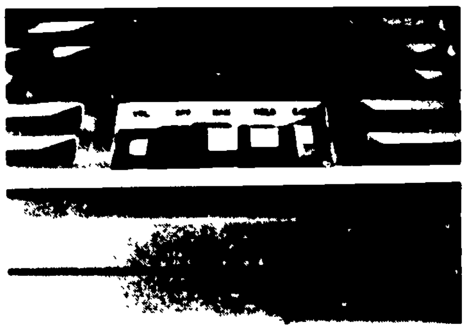


3/4 Front View

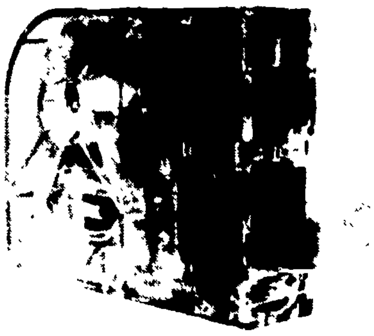
MASTERMATIC I



3/4 Front View:

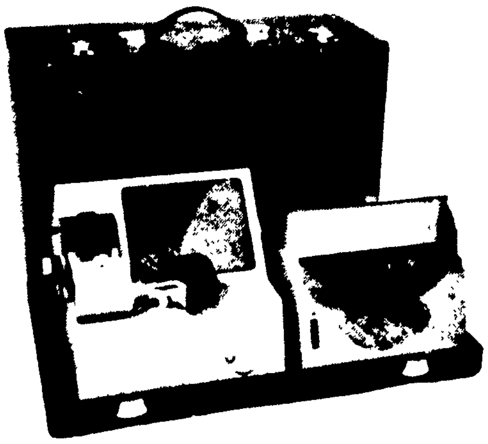


Detail of
Control Panel

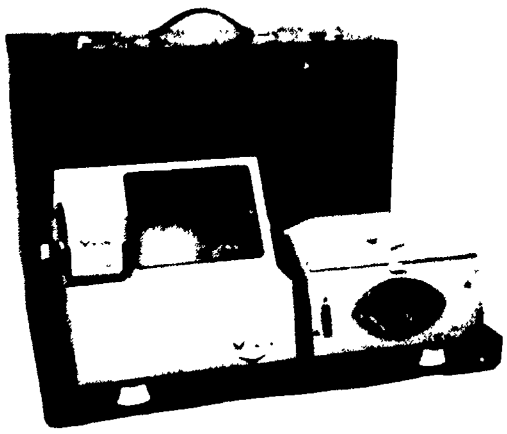


Program
Cartridge

VIEWLEX AVTD



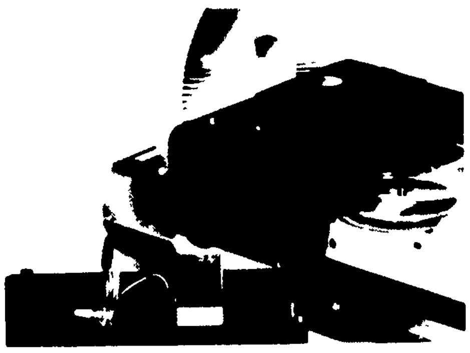
3/4 Front View
of Machine



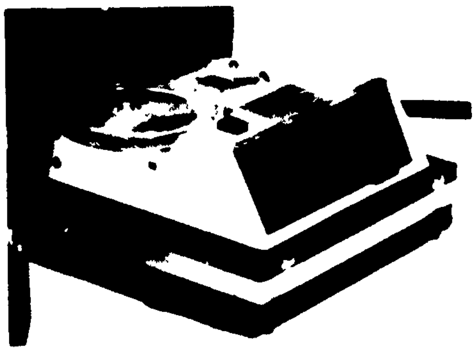
3/4 Front View
With Program
Being Loaded

CREATRON MODEL 750

3/4 Front View
of Machine and
Projection Screen



Detail of
Projector



Detail of
Tape Unit

Table II presents in summary form the ratings of the various machines on a series of points derived from the evaluation process described in this paper. Most of the ratings are confined to technical characteristics. As stated in the previous section, the final decision on the machine will be forwarded to the U. S. Public Health Service by letter, and this decision will take into account such subjective matters as the company's ability to deliver and service, price, etc. There is no doubt that, due to the uncertain state of the art, a series of trade-offs will have to be made, and the machine selected will be less than perfect for our purposes. In the meantime, careful study of Table II may be of help to research workers in audio-visual communication and programed instruction. The original filled-out evaluation sheets are on file in the office of the Medical Information Project.

Some Comments on the State of the Art

The industry producing instructional hardware will eventually have to adopt standards for compatibility of hardware to software. School and industry possess large bodies of materials that fit conventional format machines, such as film-strip projectors. If an institution does purchase a non-standard format machine, the number of programs fitting that particular size probably will be limited. The format differences require

TABLE II

MACHINE SUMMARY SHEET

Summary Key

1 Excellent
2 Satisfactory
3 Unsatisfactory

	CAPABILITY OF FORMAT HANDLING TOTAL PROGRAM	EASE OF LOADING & UNLOADING PROGRAM	OVERALL QUALITY OF CONSTRUCTION	OVERALL SERVICING	SIMPLICITY OF OPERATION	OVERALL AUDIO SYSTEM	OVERALL VISUAL SYSTEM	AUTOMATIC PROGRAM ADVANCE	AUTOMATIC QUESTIO[N] ADVANCE
AUDISCAN I	Yes	1	1	1	1	2	2	Yes	1
BESELER SALESMATE	Yes	3 Visual 2 Audio	1	2	3	1	2	Yes	3
C. B. S. A.V.T.D.		Machine not available for full evaluation							
CREATRON 750	Yes	2	2	1	3	2	2	Yes	3
DORSETT M20	No	3 Visual 2 Audio	2-3	2-3	2-3	2	2	Yes	1

TABLE II (cont'd)

	CAPABILITY OF FORMAT HANDLING TOTAL PROGRAM	EASE OF LOADING & UNLOADING PROGRAM	OVERALL QUALITY OF CONSTRUCTION	OVERALL SERVICING	SIMPLICITY OF OPERATION	OVERALL AUDIO SYSTEM	OVERALL VISUAL SYSTEM	AUTOMATIC PROGRAM ADVANCE	AUTOMATIC QUESTI ADVANC
DORSETT M70A	Yes	2	2-3	2-3	1	2	2	Yes	1
DORSETT M86A	Yes	2	2-3	2	2	2	2	Yes	1
DUKANE AV MATIC	Yes	2 Visual 1 Audio	2	2	2	2	2	Yes	2 (Switc to sto
DUKANE 14 A 525	Yes	2 Visual 1 Audio	2	2	1	2	2	Yes	1
E.R.A. 501	Yes	2-3	1	2	1	1	1	Yes	1
EXECUGRAPH 303	Yes	1 Visual 2 Audio	1	2	1	1	1	Yes	1
HOFFMAN IV	No	1	2	2-3	3	2	2	Yes	2 (Switcl to stop

TABLE II (cont'd)

	CAPABILITY OF FORMAT HANDLING TOTAL PROGRAM	EASE OF LOADING & UNLOADING PROGRAM	OVERALL QUALITY OF CONSTRUC-TION	OVERALL SERVIC-ING	SIMPLIC-ITY OF OPERA-TION	OVERALL AUDIO SYSTEM	OVERALL VISUAL SYSTEM	AUTO-MATIC PROGRAM ADVANCE	AUTO-MATIC QUESTION ADVANCE
HOFFMAN IV (modified)	Yes	1	2	1-2	1	1	2	Yes	1
LA BELLE COURIER	Yes	3 Visual 2 Audio	2-3	2	3	1	2-3	Yes	3
MAST 1700 (modified to include audio)	Visual Yes Audio No	1 Visual 3 Audio	1	2	3	3	1	Yes	2 (Switch to stop)
MASTERMATIC I	Yes	1	2	2	2	2	2	Yes	1
RALKE GRAFLEX COUSINO CUSTOM UNIT	Yes	2 Visual 1 Audio	2	2	1	1	2-3	Yes	1
SONOSCOPE MASTER	Yes	2	2	2	2	2	2	Yes	2

TABLE II (cont'd)

	CAPABILITY OF FORMAT HANDLING TOTAL PROGRAM	EASE OF LOADING & UNLOADING PROGRAM	OVERALL QUALITY OF CONSTRUC-TION	OVERALL SERVIC-ING	SIMPLIC-ITY OF OPERA-TION	OVERALL AUDIO SYSTEM	OVERALL VISUAL SYSTEM	AUTO-MATIC PROGRAM ADVANCE	AUTO-MATIC QUESTION ADVANCE
VIEWLEX A.V.T.S. (with mod-ifications)	Yes	1	2	1	1	1-2	2	Yes	1
VIEWLEX TT-1	Yes	2 Visual 1 Audio	2	2	2	2	2	Yes	2 (Switch to stop
VIDEOSONIC 102 B	No	2 Visual 1 Audio	1	2	2-3	2	2-3	Yes	1
VIDEOSONIC 901	No	2 Visual 1 Audio	2	2	2-3	2	2-3	Yes	2 (Switch to stop

that numerous machines be purchased to cover the range of materials currently available. In addition, when the purchaser produces his own program, he faces innumerable problems in putting it into a format that will fit the hardware. His program is complete; in order to convert to format he must consider differences in frame size, sprocket holes, record or tape speed, travel direction of the visual, compatibility of plugs, frequency and duration of pulses, etc.

The entire industry must eventually agree upon standards to benefit the purchases rather than the present company oriented desire to have an exclusive hold on the software materials for their particular machine. This attempt to control software markets results in manufacturers' designing machine format to a non-standard, exclusive form. The market has numerous examples of odd record sizes, unique sprocket hole locations, and special film cartridges. This practice complicates an already complicated field.

Allied to the standards problem is the need for quick and inexpensive facilities to convert any piece of material into a useable format. With many machines currently on the market, the producer must wait several weeks, or even months, to have a program converted. Some manufacturers will not bother to

convert a program unless they are guaranteed a specified number of units. If they do accept a small program order, it is often placed in an open production slot for some future date. Pricing of such conversion is generally based on the number of units involved. Consequently, the high conversion cost for single pieces of material becomes prohibitive.

With the eventual adoption of standards, companies could work together in establishing regional centers. These centers could aid the producers and users of materials by making technical advice, format templates, pulsing oscillators, and other facilities available gratis or at a nominal price. Conversion of materials could then be accomplished quickly and cheaply because of the guidance given in materials preparation, limited number of formats allowing mass production techniques, and the generally faster reaction time the regional producer requires. With this type of support, the manufacturer would be assured of an increased market.

Servicing machines is a continuous problem. One only has to visit a local school or plant to note the scope of the problem; broken machines are prevalent. The user has great difficulty in getting specialized parts and hiring qualified servicemen.

One promising solution is the adoption of modular construction techniques. Audio, logic, branching and mechanical

assemblies can be built as units which can be easily plugged into the machine's basic wiring harness. If servicing is required, a person with minimal experience could easily plug in a new circuit unit to put the machine back into operation. Both Eastman Kodak and Audiscan have adopted modular construction. They offer a stock of inexpensive modular units . replace broken ones. Eastman's new 8mm projector will be able to replace both electronic and optical assemblies as modular units. The Audiscan I has provisions for removing and repairing all circuit boards. The few components which are not on these boards are easily removed by special "pop-off" hardware and electrical connections.

Manufacturers should recognize the differences in machine requirements among various purchasers. Too often it is assumed that one machine will serve the needs of education, industry and the military. The objectives of these groups and their sub-groups are obviously quite different. Educators are traditionally slow in adopting new innovations; consequently, machine manufacturers design the equipment to meet the needs of industry or the military. When the educational market does catch up, it often must accept a machine that doesn't meet its requirements.

The point is illustrated by one manufacturer's representative who demonstrated a machine for our consideration. The

unit was originally designed so that a salesman could repeatedly present the same material to different clients. The representative was certain that these units would be ideal for doctors or students in an individual study situation. Utilization of that machine requires a capability of being able to quickly and easily change programs. Yet, these machines required the cases to be removed to gain access to the programs. The continuous loop filmstrip inside sat on a bulky metal spindle which required several minutes to thread. The machine was being promoted for a purpose different from its original design.

The broad market approach is basically due to what is viewed as economic necessity. Actually, it results in meeting the needs of only part of the market, while seriously compromising the needs of the many different users. Dissimilar markets will eventually force the manufacturers to produce several versions of the same basic machine. Perhaps a more promising solution would be to design various modular subassemblies to meet a variety of needs.

The adoption of man-machine systems puts a great responsibility on the reliability of the hardware. Tasks are assigned to machines on the assumption that they will perform. But an analysis of much of the hardware currently available indicates a low reliability factor causing the total man-machine relationship to break down.

The need for increased reliability can be found in the electronic, projection and mechanical assemblies. Companies often put more effort into aesthetic elements than engineering elements. For example, the hand grip is handsomely integrated into a case, but the unit is totally out of balance. Similarly, the plastic screen is curved to resemble a television screen, causing the center to be out of focus when the edges are sharp and vice versa.

Economic considerations appear to be a major factor in lowering the reliability of the machines. In attempting to maximize profits, components which are minimally acceptable were found operating at, or near, their maximum voltages. Plastic or thin gauge metals were used in mechanical assemblies where normal wear would eventually cause breakdowns. Several machines used wire whose gauge was small enough to cause overheating, damage to surrounding components and voltage drops. Projector lamps were pushed to give the maximum light output. Reliability of the lamp would be increased greatly if voltages were slightly dropped with thermistors or rheostats included to take care of surge voltages. Fusing increases reliability for both electronic and motor circuits. Yet, one manufacturer stated that this machine didn't have to be fused because the transistors would simply blow if there was an overload. He failed to mention the cost differential or the down-time for the machine.

Many of the reliability defects could be eliminated in the early prototypes. However, it must be remembered that the carefully machined prototype generally performs better than the mass plastic injected production units. Analysis of the first units is often bartered for early production schedules. Initially poor engineering design causes problems that are overlooked due to correction costs. One company's early model had all lens elements exposed and in a horizontal plane. Dirt build-up became so great that the image quality was seriously affected. This, and other defects, were not corrected, subsequently causing a fifty percent rejection rate in the final production units.

The above discussion has attempted to assess current problems and future direction. Progress will be made partially on the manufacturer's initiative, but mainly by the demands of the purchaser, who has increasing amounts of money and competent personnel to request and evaluate equipment. The Medical Information Project was able to match equipment to needs reasonably well because we initially identified the requirements of our system. This systems approach requires that objectives be stated. These objectives provide a tool for writing equipment specifications to meet the needs of the system. Undoubtedly, manufacturers will respond to these specifications if they are clear, reasonable and feasible.

MACHINE EVALUATION AND INFORMATION SHEET

Model:		Comments:
1. Price per unit:		
2. Quantity price breakdown:		
3. Dimensions:		
4. Weight:		
5. Power, line or battery:		
6. Quality of case construction:		
7. Dust cover:		
8. Self contained (audio-visual-screen unit):		
9. Ease of setting up:		
10. Ease of packing away:		
11. Packaging of unit:		
12. Controls		

Model:		Comments:
13. Simplicity of operation:		
14. Operation, manual, automatic pushbutton:		
15. Capability of program interruption:		
16. Compatibility of plugs:		
17. Quality of electronics construction:		
Visual: 18. Format of visual:		
19. Maximum frame capacity:		
20. Quality of image:		
21. Packaging of visual:		
22. Size of frame:		
23. Lamp size:		
24. Cooling system:		
25. Lens:		

Model:		Comments:
26. Rewind:		
27. Holding focus:		
28. Ease of cleaning aperture:		
29. Frame adjustment:		
30. Projection system:		
31. Size of screen:		
32. Screen material:		
33. Durability of screen after cleaning:		
34. Shadow box for screen:		
35. Reliability of visual system:		
36. Overall evaluation of visual system:		
Audio: 37. Format of audio:		
38. Maximum time:		

Model:		Comments:
39. Ease of changing cartridges or heads:		
40. Speeds:		
41. Self contained tape cartridge:		
42. Drive system for tape or phonograph:		
43. Automatic tape rewind:		
44. Accessibility of head for cleaning:		
45. External or built in speaker:		
46. Amplifier size:		
47. Loudspeaker, earphones, both:		
48. Audio distortion:		
49. Sync sound:		
50. Reliability of sync pulse:		
51. Pulse audible during playback:		

Model:		Comments:
52. Ease of putting on pulses:		
53. Separate track for pulse:		
54. Frequency of pulse:		
55. Overall evaluation of sound system:		
56. Overall evaluation of total system:		

The Test Machine

Program validation is said by most authorities to be the key item in the technology of programing instructional material. For the standard programed instructional materials of a verbal nature which are to be printed, the items are prepared on cards or in some other simple manner and the material is then tried out on subjects who represent the target audience. These trials are usually on an individual basis and are sometimes followed by field trials on larger populations. The results obtained from these validation studies (discussion of the items with the subjects, records of missed items, too easy items, etc.) are the data to which programers who are conscientious refer to so lovingly and which eventually make a program a program.

Audiovisual program validation is much more difficult. Peter Schreck of Borg-Warner uses cards on which an artist has prepared the visual materials, usually in watercolors. The audio is stated by the tester. This is an expensive and time consuming procedure, but it does an honest job of validation. However, there may be some question as to this approach to the visuals when you get beyond the stage of simple drawings for young children and it certainly does not meet the requirements when scientific photography is necessary.

Further, the question of the time, effort and expense of final artwork had to be met. Conceivably, hours of finished artwork might be thrown out as a result of the validation data on a six minute program segment. The solution to this problem, however, lay at hand in the now almost forgotten literature of what used to be known as the pre-production testing of instructional films. For a summary of much of this work, see Finn.[15] Beck, Lumsdaine, Rose and Van Horn, among others, showed many years ago that simple pencil sketches, when projected, usually as slides or film strips, were about as satisfactory as a motion picture and certainly an excellent guide to the instructional strengths and weaknesses of a film when used as the test instrument on a target audience.

It was therefore decided to use story board pencil sketches of the art work and photograph them for slides for the visual frames. To these, of course, would be added live photographs, particularly those requiring precise scientific photography.

These decisions set the requirements for a test machine. The machine needed to have a built-in slide projector and some form of tape carrier. It was also decided to add a response

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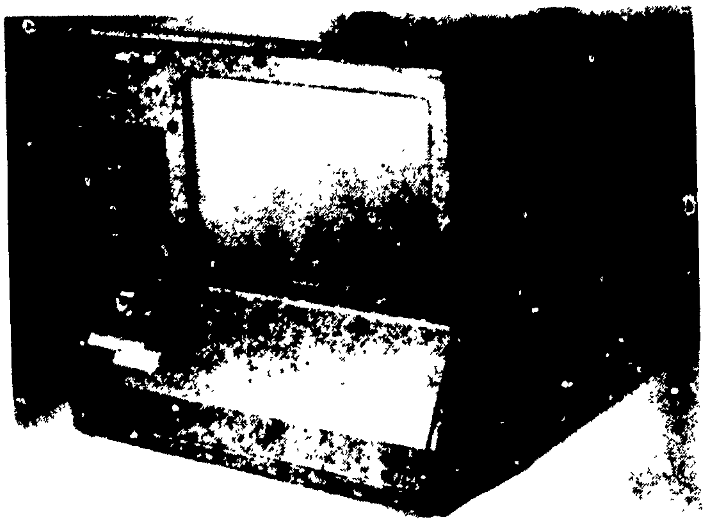
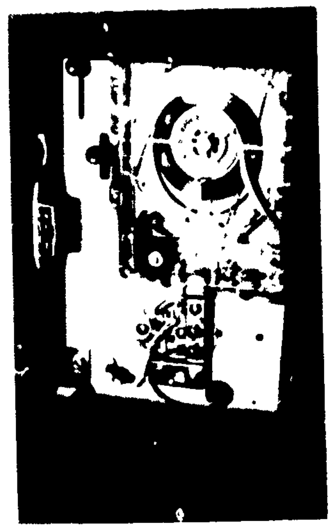
[15] James D. Finn, "The Testing of Public Relations Audio-Visual Materials," PR: The Quarterly Review of Public Relations, Volume 1, No. 5 (October, 1956).

capability in case the programers wished to use it in the validation process. A custom equipment house in Los Angeles which had built several similar machines was commissioned to build such a device. In essence, the device uses a carousel slide projector and a tape cartridge and has various stop and start and response capabilities. It can be adjusted for almost any type of programing by using the balsa wood trips on the carousel tray. This machine will present the program in slide and tape form for validation. A special electronic tape programer was also developed for beeping the tape. The test machine is illustrated on the following page.

VIS-U-GUIDE RESPONDER 700
PROGRAMMED TEACHING AID



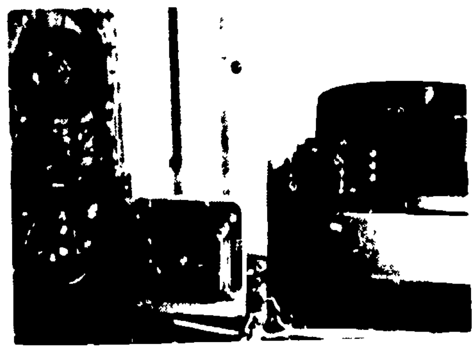
3/4 Front View



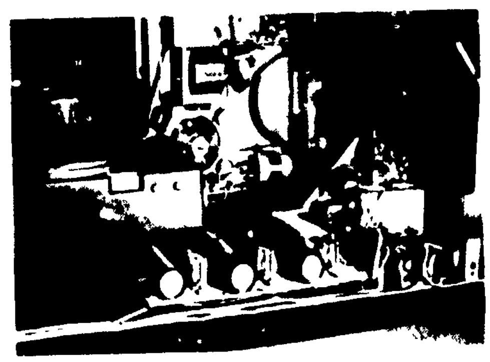
Detail of
Tape Deck

Detail of
Control
Panel

Detail of
Visual Program
Being Loaded



Detail of
Tape Deck
and Question
Micro-switches



Detail of
Projector and
Logic Circuit

SPECIFICATIONS

SIZE: 18 X 18 X 24 INCHES
CABINETRY: WOOD CONSTRUCTION COVERED WITH HEAVY DUTY VINYL FABRIC
WEIGHT: 35 POUNDS
SCREEN: 8 X 12 INCHES - PLEXIGLASS
PROJECTOR: KODAK CAROUSEL - MODEL 700
SLIDE CAPACITY: 80 FRAMES
LENS: f3.5 3 INCHES
LAMP: DEK 500 WATT
FAN: CONVECTION FANS
TAPE: 1/4" CONTINUOUS LOOP FIDELIPAC CARTRIDGE
TAPE CARTRIDGE CAPACITY: TWENTY MINUTES
RESPONSE: MULTIPLE CHOICE (3)

ATTACHMENT C

Company	Name of Contact
Argus Execugraph Corporation 1321 East Franklin El Segundo, California 90245	Mr. Kenneth B. Thomson 8831 Sunset Blvd. Los Angeles, California
Audiscan, Incorporated 1414 130th Avenue, N. E. Bellevue, Washington 89004	Mr. Robert L. Cane
Charles Beseler Company 219 South 18th Street East Orange, New Jersey 07018	Mr. Carroll Newcomb Photo and Sound Company 5515 Sunset Blvd. Los Angeles, California 90028
Borg-Warner Corporation Wolf and Algonquin Roads Des Plaines, Illinois 60018	Mr. Peter Shreck
CBS Laboratories High Ridge Road Stamford, Connecticut 06905	Mr. Barton C. Conant
Cousino Orrtronics, Inc. Willis Day Industrial Park P. O. Box 864 Toledo, Ohio 43601	Mr. William Ralke 641 N. Highland Avenue Los Angeles, California 90036
Creatron Services, Incorporated 36 Cherry Lane Floral Park, L. I., New York 11001	Mr. Wallace Schwarz
Dorsett Industries, Incorporated 1225 West Main Street Norman, Oklahoma 73069	Mr. Loyd G. Dorsett
Dukane Corporation St. Charles, Illinois	Mr. William C. Ralke 641 N. Highland Avenue Los Angeles, California 90036
Educational Research Associates Box 8141 Albuquerque, New Mexico	Mr. John Leslie

Company	Name of Contact
Elco Corporation (Mastermatic) Willow Grove, Pennsylvania 19090	Mr. Eric F. Burtis 2549 Middlefield Road Redwood City, California 94063
Graflex, Incorporated 3750 Monroe Street Rochester, New York	Mr. William C. Ralke 641 N. Highland Avenue Los Angeles, California 90036
Hoffman Information Systems, Inc. 2626 Peck Road Monrovia, California	Mr. Lou Stoyonoff
Hughes Aircraft Company Videosonic Systems Division P. O. Box 3310 Fullerton, California 92634	Mr. Robert A. Tomlinson
Labelle Industries, Incorporated 510 S. Worthington Street Oconomowa, Wisconsin	Mr. Carroll Newcomb Photo and Sound Company 5515 Sunset Blvd. Los Angeles, California 90028
Mast Development Company 2212 East 12th Street Davenport, Iowa	Mr. Fredrick K. Norton 4604 Indiana Avenue La Canada, California
Sonoscope, Incorporated 4904 Ninth Avenue South St. Petersburg, Florida 33707	Mr. Walter Liddy
Viewlex, Incorporated Veterans Memorial Highway and Broadway Holbrook, L.I., New York 11741	Mr. Lou Peirez
	Mr. Robert Livingston 13075 Blairwood Drive North Hollywood, California